



ANATOMY

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Lecture 7

Frontal Lobe

Its posterior part; Precentral area; is motor in function while its anterior part; prefrontal area; is responsible for the higher mental functions.

	Site	Function	Lesion
Precentral area			
Primary motor area MI (Area 4)	precentral gyrus and ant. part of paracentral lobule	Initiates discrete voluntary movements (which were planned in area 6).	Contralateral hemiplegia especially skilled, fine movements.
Premotor area (Area 6)	in front of area 4 (in sup, mid, & inf. frontal gyri). It extends also on medial surface of cerebral hemisphere.	<ul style="list-style-type: none"> *Plans the movement *stores the plan. *adjusts the posture to start the movement. * It inhibits muscle tone and grasp reflex. 	Awkwardness of movements “apraxia”, spasticity of muscles & reappearance of grasp reflex.
Frontal Eye Field I (Area 8)	In front of area 6 (in superior & middle frontal gyri).	It is part of frontal eye field responsible for voluntary conjugate eye movements. Its stimulation leads to contralateral deviation of both eyes.	<ol style="list-style-type: none"> 1. Ipsilateral deviation of both eyes (towards side of lesion). 2. Inability to turn eyes to opposite side. Note: (Reflex conjugate eye movement is not affected because it is controlled by occipital eye field).
Broca's Area (Areas 44 & 45):	in the pars triangularis (area 45) and the pars opercularis (area 44) of the inferior frontal gyrus.	contains the motor speech area (Anterior Speech Area). It receives data from the sensory speech “Wernicke's” area. It programs a sequence of muscle contractions necessary to produce intelligible words & project these orders to the nearby area 4.	Expressive (motor) Aphasia; in which the patient cannot pronounce the word easily, but selects proper words.
Supplementary motor area (MII)	on the medial surface of hemisphere within the medial frontal gyrus	It stores programmed motor sequences for stereotyped movements. It also contains a superior speech center.	leads to akinetic mutism (temporary inability to move & aphasia).

Prefrontal Area

1. Remainder of sup., middle, and inf. frontal gyri.
2. Orbital gyri.
3. Most of medial frontal gyrus.

It has a role in intelligence, normal expression of emotion, ability to predict consequences of an action, so it affects behavior and personality.

Changes in behavior, personality and mood

Extra Note

Body representation

In Primary motor area MI (Area 4) : it contains a map of the contralateral ½ of the body represented upside down (motor homunculus) i.e., the face is lower down & the leg and foot in the paracentral lobule.

Representation is proportionate to skill; i.e., parts with fine skilled movements (e.g. hands) occupy larger areas.

In Supplementary motor area (MII) : bilateral (its stimulation evokes movements in both contralateral and ipsilateral limbs). The head is anterior & the leg is posterior.

Parietal Lobe

Contains general sensory areas:

A. 2 sensory areas:

the first somatosensory area (SI) and the second somatosensory area (SII).

B. 2 parietal lobules:

the superior contains the sensory association area

the inferior is responsible for body orientation + contains the sensory speech area of Wernick.

	Site	Function	Lesion
First Somatosensory area (SI)	Postcentral gyrus + post part of paracentral lobule.	it receives sensory impulses from the VPLN & VPMN of thalamus which receive impulses from medial, spinal, and trigeminal lemnisci. Its ant. Part (Area 3) receives cutaneous stimuli and a its post. part (Areas 1&2) receives proprioceptive stimuli	contralateral hemianesthesia = Impaired sensation on opposite side of body.
Second somatosensory area (SII)	In the superior lip of post. ramus of lateral sulcus behind the central sulcus.	It is concerned with perception of transient sensory stimuli	No recognizable sensory loss.
Taste (gustatory) area (Area 43)	In the superior lip of post. ramus of lateral sulcus (parietal operculum) extending into the anterior part of insula.	receives ipsilateral solitario-thalamo-cortical fibers via the VPMN of thalamus.	*****
Superior Parietal Lobule & precuneus (Areas 5&7)	*****	Receives impulses from SI, integrates the sensations stores them as long-term memories of past experiences. It contains stereognosis center.	astereognosis (inability to recognize familiar objects by touch).
Inferior Parietal Lobule	supra marginal gyrus (Area 40) and angular gyrus (Area 39).	They are parts of Wernicke's area (sensory speech area) which is present only in the dominant hemisphere. Wernicke's area includes also the posterior parts of sup. & middle temporal gyri, i.e. Wernicke's area lies in parietal and temporal lobes. It is responsible for comprehension (understanding) of auditory and visual information. It selects suitable words & sends them to the motor speech area of Broca to produce speech	Sensory (Receptive) Aphasia. The patient cannot understand spoken or written words, thus speaks wrong words but fluently; in contrast to motor aphasia, the patient does not feel that he has any problem.

Extra Note

- **First Somatosensory area (SI)** : Body representation: The opposite side of body is represented in an inverted fashion (sensory homunculus) with face down and foot area in the post. part of paracentral lobule. Representation is proportionate to the sensitivity of the part.
- **Second somatosensory area (SII)**: Representation: The face is anterior while the leg is posterior. The body is bilaterally represented.
- **In the non-dominant hemisphere**: these areas are responsible for orientation of the contralateral 1/2 of the body in space. Its lesion leads to contralateral hemineglect in which the patient fails to recognize the opposite side of body as its own i.e. the person may shave half his beard only or dress one sleeve of a jacket only.

- Three speech centers are known: 1. Anterior (Broca's), 2. Posterior (Wernicke's) & 3. Superior (in supplementary motor area MII in medial frontal gyrus).

Temporal Lobe

	Site	Function	Lesion
Primary Auditory area AI (Area 41, 42)	present in inf. lip of lateral sulcus (Heschl gyrus) + the adjacent part of sup. temporal gyrus .	receives the auditory radiation from the MGB bringing impulses from both ears. Here, auditory stimuli reach consciousness.	impaired hearing not loss of hearing because the cochlea is bilaterally represented.
Secondary Auditory area AII (Area 22)	in the sup. temporal gyrus around the primary auditory area.	this area understands the meaning of auditory stimuli by associating them with past experience.	Inability to understand sounds (auditory verbal agnosia).
Vestibular area	in the sup. temporal gyrus close to the primary auditory area.	receives information about the head position & movements from the vestibular nuclei after relaying on the VPMN of thalamus.	*****
Facial Recognition Area	on inferior surface of temporal and occipital lobes	*****	Bilateral lesion: prospagnosia = inability to recognize people by faces
Olfactory areas (piriform cortex)	1. 1ry olfactory area: in 3 regions: uncus + part of amygdala + apex of insula. 2. 2ry olfactory area: in para hippocampal gyrus which also contains center		
Visual association areas	in middle & inferior temporal gyri.		

Occipital Lobe

	Site	Function	Lesion
Primary Visual area (Area 17)	extends below precalcarine sulcus and on both sides of post-calcarine sulcus. It extends on lateral surface of cerebral hemisphere only till lunate sulcus.	Receives Visual stimuli from lateral geniculate body (LGB).	homonymous hemianopia (loss of opposite field of vision).
Visual Association Areas (Areas 18 & 19)	lie around area 17.	<ol style="list-style-type: none"> 1. Store past visual experience to identify objects and help discriminate color. 2. Occipital eye field is present within areas 17&18. It controls involuntary (reflex) conjugate eye movement. 	visual agnosia: the patient cannot understand the meaning of what is seen.

Extra Note

1. Other visual association areas: are present in temporal & parietal lobes.
2. The occipital lobe: also contains a part of Facial recognition Area.

Differet btw :

motor homunculus in Primary motor area MI (Area 4)////////**sensory homunculus** in First Somatosensory area (SI)

motor aphasia, the patient does not feel that he has any problem.+ patient cannot pronounce the word easily, but selects proper words.

Sensory (Receptive) Aphasia. The patient cannot understand spoken or written words, thus speaks wrong words but fluently

represented upside down Primary motor area MI (Area 4)

Represent head anterior leg posterior :

- Supplementary motor area (MII)
- Second somatosensory area (SII)

present only in Dominant Hemisphere :

- Broca's Area (Areas 44 & 45)
- Inferior Parietal Lobule

Present face down and foot area in the post : First Somatosensory area (SI)

- **Apraxia**: Awkwardness of movements
- **Motor Aphasia** : in which the patient cannot pronounce the word easily, but selects proper words.
- **Hemianesthesia** : Impaired sensation
- **Astereognosis** : inability to recognize familiar objects by touch
- **Sensory Aphasia** : The patient cannot understand spoken or written words, thus speaks wrong words but fluently
- **Prospagnosia** : inability to recognize people
- **Homonymous hemianopia** :loss of opposite field of vision
- **Visual agnosia**: the patient cannot understand the meaning of what is seen.

Lecture 8

Efferent

General somatic efferent (GSE) column	from myotomes (extraocular muscles and tongue muscles) i.e. it is somatomotor	a. Nucleus of III		(in the midbrain at level of superior colliculus).	
		b. Nucleus of IV		(in the midbrain at level of inferior colliculus).	
		c. Nucleus of VI		(in pons).	
		d. Nucleus of XII		(in medulla oblongata).	
Special visceral efferent (SVE) column	branchiomotor supplying skeletal muscles that develop from the visceral (branchial or pharyngeal) arches	a. Motor nucleus of V		in pons	(supply muscles of the 1st arch).
		b. Motor nucleus of VII			(supply muscles that developed from the 2nd arch)
		c. Nucleus Ambiguus:	IX	in medulla oblongata	supplying muscles that develop from 3rd arch: stylopharyngeus.
X & XI	supplying muscles that develop from the 4th & 6th arches; muscles of palate, pharynx and larynx				

General visceral efferent (GVE) column	preganglionic parasympathetic fibers	Edinger Westphal nucleus of (III)	Midbrain	supply ciliary muscle and sphincter pupillae muscle.
		Superior salivatory nucleus (VII)	pons	supply submandibular and sublingual salivary glands.
		Special lacrimatory nucleus (VII)		supply lacrimal gland
		Uncertain nucleus (VII)		supply glands in pharynx, palate and nose.
		Inferior salivatory nucleus (IX):	in medulla oblongata	supply parotid gland
		Dorsal vagal nucleus of (X)		supply parasympathetic fibers to organs of the CVS, bronchial tree and most of the GIT (foregut & midgut).

AFFERENT

General & special visceral afferent (GVA & SVA) columns	Nucleus Solitarius	receives sensation from viscera (GVA) taste sensation (SVA) via cranial nerves VII, IX, X.
General somatic afferent (GSA) column	Main sensory nucleus of V	receives crude touch from the head.
	Spinal nucleus of V	receives pain & temperature from the head
	Mesencephalic nucleus of V	receives proprioception from the head
Special somatic afferent (SSA) column	Cochlear and Vestibular nuclei.	

Purely sensory ... Purely motor ... mixed

Oculomotor Nerve	Motor Nucleus (GSE)	supply all extra-ocular muscles except the superior oblique (supplied by IV) and the lateral rectus (supplied by VI).	
	Parasympathetic Nucleus (Edinger Westphal Nucleus) (GVE):	supply the ciliary muscle & sphincter pupillae muscle.	
Trochlear nerve	(GSE)	supplies one muscle in the eye “superior oblique”	
Trigeminal nerve	Motor Nucleus (SVE)	supply muscles that developed from the 1st pharyngeal arch (4 muscles of mastication & 4 other muscles; tensor palati, tensor tympani; anterior belly of digastric & mylohyoid)	
	sensory nuclei: (GSA) column	Main Sensory Nucleus	receives touch fibers from head & face
		Spinal Nucleus of V	receives pain & temperature from head & face. It receives also GSA sensory fibers from VII, IX & X cranial nerves
		Mesencephalic Nucleus	receives proprioceptive fibers from head & face. It contains pseudounipolar cells which are considered as 1st order neuron.
Abducent nerve	(GSE)	supplies one muscle in the eye lateral rectus	
Facial nerve	Motor Nucleus (SVE)	supply muscles that develop from the 2nd pharyngeal arch (muscles of facial expression, platysma, posterior belly of digastric, stylohyoid & stapedius).	
	Parasympathetic Nuclei (GVE)	Superior Salivatory nucleus	supply submandibular & sublingual salivary glands.
		Lacrimary nucleus	supply lacrimal gland
		Uncertain nucleus	supply glands of palate, pharynx & nose.
	Nucleus Solitarius (SVA)	upper part receives taste fibers carried by chorda tympani from anterior 2/3 of tongue & by the greater petrosal nerve from the soft palate.	
Spinal Nucleus of Trigeminal (GSA)	receives fibers of general sensation from concha of ear.		

Vestibulo-cochlear nerve	Vestibular & Cochlear Nuclei (SSA)	lie at the ponto-medullary junction
Glossopharyngeal nerve	Nucleus Ambiguus (SVE)	supply only muscle that develops from the 3rd pharyngeal arch (stylopharyngeus muscle)
	Parasympathetic nucleus (Inferior salivatory nucleus) (GVE)	supply parotid gland via auriculotemporal nerve
	Nucleus Solitarius (SVA)	middle part receives fibers of IX nerve carrying taste from posterior 1/3 of tongue & circumvallate papillae.
	Spinal Nucleus of Trigeminal (GSA)	receives fibers of IX nerve carrying general sensation from the oropharynx, tonsils, posterior 1/3 of tongue, auditory tube & middle ear
Vagus nerve	Nucleus Ambiguus (SVE)	supply muscles that develop from 4th & 6th pharyngeal arches which include muscles of palate (except tensor palati), muscles of pharynx (except stylopharyngeus) & muscles of larynx
	Parasympathetic Nucleus (dorsal vagal nucleus) (GVE)	Its fibers are motor to the involuntary muscles in thorax (heart & bronchial tree) and abdomen (GIT) till the end of the midgut.
	Nucleus Solitarius (SVA & GVA)	*lower part receives fibers of X nerve carrying taste from most posterior part of tongue, valleculae & epiglottis. * It also receives general visceral sensations from the organs supplied by the vagus nerve.
	Spinal Nucleus of Trigeminal (GSA)	receives fibers of X nerve carrying general sensory fibers of auricular branch of X.
Accessory nerve	Spinal part	*take origin from the Spinal Nucleus located in the ventral horn of upper five cervical segments of the spinal cord. *They supply the sternomastoid & trapezius.
	Cranial part	*take origin from the lower part of the Nucleus Ambiguus (SVE) *Supply muscles of palate (except tensor palati), muscles of pharynx (except stylopharyngeus) & muscles of larynx
Hypoglossal nerve	The hypoglossal nucleus (GSE)	supply all muscles of tongue except the palatoglossus muscle